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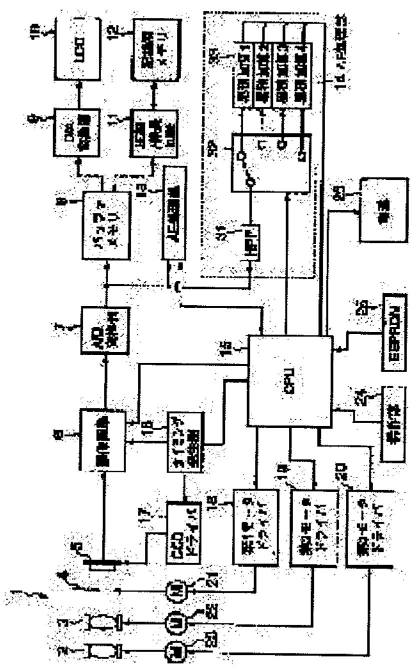
(54) ELECTRONIC IMAGE PICKUP UNIT



(57)Abstract:

PROBLEM TO BE SOLVED: To obtain an electronic image pickup unit that automatically adjusts a focus at high speed with high accuracy by detecting a focus error corresponding to a plurality of lens positions from an image signal of one pattern.

SOLUTION: In an electronic still camera where signal charges stored corresponding to an object image formed by an image pickup optical system 1 are read from a CCD 5 and displayed on an LCD 10 via an image pickup circuit 6, an A/D converter, a buffer memory 8 and a D/A converter 9 or recorded in a recording memory

12 via a compression/expansion circuit 11, photoelectric conversion elements of the CCD 5 are divided into a plurality of groups consisting of combinations of a plurality of lines placed at a prescribed interval, the charge storage start timing is controlled so that the elements belonging to the same group start storage of charges in the same timing and the elements belonging to the different groups start storage of charges in the different timings, a focal position is obtained from image signals read from each of the photoelectric conversion elements by an AF processing section 14 and the focus lens group 3 is driven on the basis of the position above.

CLAIMS

[Claim(s)]

[Claim 1]An electronic image pickup device comprising:

An imaging lens to which an imaging surface is made to carry out image formation of the object image.

An image sensor which accumulates an electric charge corresponding to an object image by which was divided into two or more photoelectric conversion element groups which consist of combination of two or more lines arranged with a prescribed interval while two or more optoelectric transducers are arranged by two-dimensional array form, and image formation was carried out to an imaging surface with said imaging lens.

A control means which controls charge storage start timing of said image sensor so that an optoelectric transducer which an optoelectric transducer belonging to the same photoelectric conversion element group of said image sensor starts a charge storage to the same timing, and belongs to a different photoelectric conversion element group starts a charge storage to mutually different timing.

A driving means which drives said imaging lens to an optical axis direction based on a picture signal read from each photoelectric conversion element group of said image sensor, respectively.

[Claim 2]The electronic image pickup device according to claim 1, wherein said driving means drives said imaging lens to a prescribed position synchronizing with charge storage start timing of each photoelectric conversion element group of said image sensor.

[Claim 3]While said driving means drives said imaging lens to a prescribed position

synchronizing with charge storage start timing of each photoelectric conversion element group of said image sensor, The electronic image pickup device according to claim 1 driving said imaging lens to a focusing position based on a mutual comparison result of a high frequency component of a picture signal read from said each photoelectric conversion element group.

[Claim 4]The electronic image pickup device according to claim 3 said driving means's making one position of said prescribed positions said focusing position, and driving said imaging lens to this focusing position.

[Claim 5]A vertical transfer part which transmits perpendicularly an electric charge by which said image sensor was accumulated in said optoelectric transducer and said optoelectric transducer, A horizontal transfer part which transmits horizontally an electric charge transmitted by this vertical transfer part, A transfer gate individually provided between said optoelectric transducer and said vertical transfer part corresponding to each optoelectric transducer in order to transmit an electric charge accumulated in said optoelectric transducer to said vertical transfer part, The electronic image pickup device according to claim 1, wherein a preparation and said transfer gate transmit an electric charge accumulated in said optoelectric transducer by impressing a transfer pulse for every predetermined time interval ranging from a charge storage start to predetermined time of said optoelectric transducer to said vertical transfer part.

[Claim 6]The electronic image pickup device according to claim 5 provided with a means to change an applied period of said transfer pulse according to a luminosity of a photographic subject.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the automatic-focusing regulation system which was applied to the electronic image pickup device which picturizes using a solid state image pickup device like a CCD two-dimensional image sensor, especially made high-speed operation possible.

[0002]

[Description of the Prior Art]Image formation of the object image is carried out according to an imaging optical system on a solid state image pickup device, for example, a CCD two-dimensional image sensor, it changes into an electrical signal, and the electronic image pickup device which records the picture signal acquired by this on a recording medium like semiconductor memory or a magnetic disk, and what is called an electronic "still" camera are spreading widely.

[0003]In such an electronic "still" camera, generally the focal error of the focus lens of an imaging optical system is detected, and the auto-focusing (AF) system which moves a focus lens to an optical axis direction based on the information on this focal error, and performs a focus automatically is formed. The imager AF system which detects a focal error as one of the AF systems in an electronic "still" camera based on the contrast of the photographic subject picturized by the image sensor, and judges a focusing position is known.

[0004]More specifically by the imager AF system, a highpass filter extracts a high frequency component from the picture signal acquired by an image sensor, moving a focus lens to an optical axis direction in step. That is because the contrast of an object image serves as the maximum and the high frequency component of a picture signal also serves as the maximum simultaneously, when a focus is adjusted correctly. And the amount of high frequency components corresponding to each focusing lens position (for example, accumulation value of a high frequency component) is measured, the maximum contrast point that the amount of high frequency components shows a peak is judged to be a focusing position, and a focus lens group is moved to this focusing position. This AF system is called what is called a mountain-climbing method. Such a conventional AF system is indicated by JP,9-168113,A, JP,9-200597,A, etc., for example.

[0005]However, in order to detect the focal error in two or more focusing lens

positions and to judge a focusing position in the conventional AF system. The picture signal for one screen (one frame or 1 field) is needed for every focusing lens position, and there is a problem that time required for AF operation will become long.

[0006]For example, when a focusing lens position is set as 24 steps, it is necessary to acquire the picture signal for 24 screens with an image sensor for AF, and time required for AF operation also turns into 24 frame periods or 24 field periods. Therefore, the photographic subject which moves at high speed cannot fully be followed. If the number of steps of a focusing lens position is lessened, the time required of AF operation will be shortened, but AF accuracy will fall so much.

[0007]

[Problem(s) to be Solved by the Invention]As mentioned above, in the AF system in the conventional electronic "still" camera. From needing the picture signal for one screen for every focusing lens position, in order to detect a focal error and to judge a focusing position. In order to be unable to perform high-speed AF operation and to accelerate AF operation, when the number of steps of the focusing lens position was lessened, there was a problem that the accuracy of AF operation fell.

[0008]

[Means for Solving the Problem]As this invention detects a focal error respectively corresponding to two or more lens positions from a picture signal of one screen and can judge a focusing position, an object of this invention is to provide an electronic image pickup device which can perform high-speed and highly precise automatic-focusing regulation.

[0009]This invention is characterized by an electronic image pickup device comprising the following.

An imaging lens to which an imaging surface is made to carry out image formation of the object image.

An image sensor which accumulates an electric charge corresponding to an object image which was divided into two or more photoelectric conversion element groups which consist of combination of two or more lines arranged with a prescribed interval while two or more optoelectric transducers are arranged by two-dimensional array form, and in which image formation was carried out to an imaging surface by imaging optical system.

A control means which controls charge storage start timing of an image sensor so that an optoelectric transducer which an optoelectric transducer belonging to the same photoelectric conversion element group of this image sensor starts a charge storage to the same timing, and belongs to a different photoelectric conversion element group

starts a charge storage to mutually different timing.
A driving means which drives an imaging lens to an optical axis direction based on a picture signal read from each photoelectric conversion element group of an image sensor, respectively.

[0010]Thus, in order to read a signal charge in which accumulation was started to timing which is mutually different in this invention in each photoelectric conversion element group by which an image sensor was divided as a picture signal, By performing accumulation operation of a signal charge in each optoelectric transducer, moving an imaging lens to an optical axis direction, focal error information in several positions from which an imaging lens differs based on each picture signal read from each photoelectric conversion element group is acquired, and a focusing position can be judged based on this.
[0011]That is, improvement in the speed of AF (automatic-focusing regulation) operation is possible by making ****** which judges a focusing position from a picture signal for one screen obtained by one image pick-up of an image sensor, and moving an imaging lens to this focusing position. Since it is not necessary to lessen the number of steps of an imaging lens position for improvement in the speed of AF operation, accuracy of AF operation is also secured.
[0012]Here, as for a driving means, it is preferred to drive an imaging lens to a prescribed position synchronizing with charge storage start timing of each photoelectric conversion element group of an image sensor. In this case, what is necessary is to compare a high frequency component of a picture signal read from each photoelectric conversion element group in each position of an imaging lens, to judge a focusing position based on that mutual comparison result, and just to make it drive an imaging lens to a focusing position. Since charge storage time and a position of an imaging lens correspond if it does in this way, a focusing position can be more correctly judged from a picture signal, and accuracy of AF operation improves further.
[0013]By making it drive an imaging lens to this focusing position by making into a focusing position one position of the lens positions driven to timing which synchronized with charge storage start timing of each photoelectric conversion element group in a driving means, As compared with a case where candidates of a focusing position including positions other than these lens positions are set up, a focusing position is simply judged with a small operation amount, and it becomes possible to move an imaging lens to a focusing position at high speed.
[0014]An image sensor is provided with the following.

For example, the above-mentioned optoelectric transducer.
A vertical transfer part which transmits perpendicularly an electric charge accumulated in these optoelectric transducers.
A horizontal transfer part which transmits horizontally an electric charge transmitted by this vertical transfer part.
A transfer gate individually provided between an optoelectric transducer and a vertical transfer part corresponding to each optoelectric transducer in order to transmit an electric charge accumulated in an optoelectric transducer to a vertical transfer part.
And a transfer gate transmits an electric charge accumulated in an optoelectric transducer to a vertical transfer part by giving a transfer pulse for every predetermined time interval ranging from a charge storage start to predetermined time of an optoelectric transducer.

[0015]Thus, if a transfer gate is individually provided corresponding to each optoelectric transducer, it will become possible by changing applying timing of a transfer pulse to a transfer gate for every photoelectric conversion element group to change mutually charge storage timing of each photoelectric conversion element group as mentioned above.

[0016]If it is made to change an applied period of a transfer pulse to a transfer gate according to a luminosity of a photographic subject in such an image sensor, That is, since it will not be based on a luminosity of a photographic subject but a picture signal of a correct level will be acquired if an applied period of a transfer pulse is shortened when a photographic subject is bright, and an applied period of a transfer pulse is lengthened when a photographic subject is dark, it is not based on a luminosity of a photographic subject, but good AF operation becomes possible.

[0017]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described with reference to drawings.

[0018]Drawing 1 is a block diagram showing the composition of the electronic image pickup device concerning one embodiment of this invention. After object light passes the focus lens group 3 which is the zoom lens group 2 and imaging lens which constitute the imaging optical system 1 provided in the lens barrel which is not illustrated in drawing 1, It enters into the solid state image pickup device (only henceforth CCD) 5, for example, a CCD two-dimensional image sensor, via the diaphragm 4 which is a light intensity adjusting means. Thereby, image formation of the object image is carried out on the imaging surface of CCD5.

[0019]CCD5 arranges two or more optoelectric transducers called a pixel to

two-dimensional matrix form, it constitutes an imaging surface, and arranges a light filter to an imaging surface further. Drive controlling of CCD5 is carried out by CCD driver 17, and it accumulates the signal charge corresponding to the object image in which image formation was carried out to the imaging surface by the object light which passed the imaging optical system 1 and the diaphragm 4. The signal charge accumulated in this CCD5 is read as an electrical signal called a pixel signal, and is inputted into the image pick-up circuit 6. In the image pick-up circuit 6, the picture signal of a predetermined format is generated by performing processing of CDS (correlation double sampling), AGC (automatic gain control), and others.

[0020]After the picture signal generated in the image pick-up circuit 6 is changed into a digital signal by A/D converter 7, it is temporarily memorized by the buffer memory 8. The picture signal read from the buffer memory 8 is returned to an analog signal by D/A converter 9, after being changed into the gestalt which was further suitable for the reproducing output, is supplied to LCD(liquid crystal display) 10, and is displayed as a picture.

[0021]Compression / expansion circuit 11 is further connected to the buffer memory 8, and the memory 12 for record which is a recording medium for recording image data and the accompanying data on this compression expansion circuit 11 is connected.

[0022]The compression expansion circuit 11 consists of the compression circuit unit and the expansion circuit unit. The compression circuit unit performs processing for considering it as a gestalt suitable for record in the memory 12 for record by reading the picture signal memorized by the buffer memory 8, and performing compression (coding) processing. The expansion circuit unit performs processing for considering it as a gestalt suitable for reproducing outputs, such as a display and a print, by reading the picture signal recorded on the memory 12 for record, and performing extension (decryption) processing.

[0023]Solid type semiconductor memory, for example like [the memory 12 for record] a flash memory, The thing of various gestalten, such as a magnetic recording medium like a hard disk or a floppy disk besides semiconductor memory like the card shape flash memory which consisted of the shape of a card type or stick shape, and was constituted removable to the device, can be used.

[0024]The picture signal outputted from A/D converter 7 is supplied to the air entrainment part 13 and the AF treating part 14. The air entrainment part 13 receives the picture signal outputted from A/D converter 7, and performs data processing which makes a subject accumulation of the pixel signal from each pixel. And the air entrainment part 13 is a circuit which performs automatic exposure (AE) processing

which adjusts a light exposure automatically via CPU15 based on this AE evaluation value, after calculating the AE evaluation value (photometry value) according to the luminosity of the photographic subject based on this accumulation value.
[0025]The AF treating part 14 extracts the high frequency component with the highpass filter 31 in response to the picture signal outputted from A/D converter 7. And the AF treating part 14 is a circuit which performs automatic-focusing regulation (AF) processing via CPU15 based on the AF rating value concerned, after computing the AF rating value corresponding to the amount of outline components of an object image by performing accumulation processing to this high frequency component. With the electronic image pickup device shown in drawing 1, the example of the AF treating part 14 constituted by the switcher 32 and the accumulation part 33 is indicated to be the highpass filter 31. Detailed operation of this AF treating part 14 is mentioned later.
[0026]CPU15 manages control of the whole imaging device. For example, the timing generator 16, 1st Motor Driver 18, 2nd Motor Driver 19, 3rd Motor Driver 20, the final controlling element 24, EEPROM25, and the cell 26 besides the air entrainment part 13 which CPU15 mentioned above, and the AF treating part 14 are connected. The timing generator 16 generates various kinds of timing signals supplied to CPU15, CCD driver 17, and the image pick-up circuit 6.
[0027]1st Motor Driver 18 performs drive controlling of the diaphragm drive motor 21 which drives the diaphragm 4. CPU15 performs AE control which extracts that a proper light exposure is obtained and adjusts the amount of diaphragms of 4 by controlling this 1st Motor Driver 18 based on the AE evaluation value computed in the air entrainment circuit 13.
[0028]2nd Motor Driver 19 performs drive controlling of the focal motor 22 which drives the focus lens group 3. CPU15 performs AF control which moves the focus lens group 3 to an optical axis direction so that a focusing state may be acquired by controlling this 2nd Motor Driver 19 based on the AF rating value computed in AF calculation circuit 14.
[0029]3rd Motor Driver 20 performs drive controlling of the zoom motor 23 which drives the zoom lens group 2. CPU15 performs zoom control which moves the zoom lens group 2 to an optical axis direction so that desired variable power operation may be obtained by controlling 3rd Motor Driver 20 according to the command signal from this zoom switch, when the zoom switch in the final controlling element 24 mentioned later is operated.
[0030]The final controlling element 24 consists of two or more operation switch groups which generate the command signal for making various kinds of operations

perform, and are transmitted to CPU15. The main power supply switch made to specifically generate the command signal for the final controlling element 24 starting an imaging device, for example, and making current supply perform, The release switch made to generate the command signal for making photography/recording operation start, It has the regeneration switch made to generate the command signal for making reproduction motion start, the zoom switch (a zoom-in switch and zoom down switch) made to generate the command signal for moving the zoom lens group 2 and making variable power operation start, etc.

[0031]The 1st stage release switch made to generate the command signal which makes the air entrainment and AF processing in which a release switch is performed in advance of photographing operation start, It consists of the 2nd stage release switch made to generate the command signal which makes actual imaging operation start in response to the command signal generated by this 1st stage release switch.

[0032]EEPROM25 is a rewritable memory electrically and has memorized beforehand the data used in order to make various kinds of control programs and various kinds of operations perform.

[0033]The cell 26 is controlled by CPU15 and performs current supply to each part of an imaging device.

[0034]Next, the AF system in this embodiment is explained in detail.

[0035]Drawing 2 is a figure showing the composition of CCD5 in this embodiment. This CCD5 is interline transmission type CCD, and it consists of the photo-diode 41, the transfer gate 42, the vertical transfer part 43, the horizontal transfer part 44, and the output amplifier 45 which are the optoelectric transducers arranged by two-dimensional array form.

[0036]The signal charge accumulated in the photo-diode 41 is transmitted to the vertical transfer part 43 which comprised CCD via the transfer gate 42, and is perpendicularly transmitted by this vertical transfer part 43. and a signal charge -- the vertical transfer part 43 -- it is horizontally transmitted by the horizontal transfer part 44 which similarly comprised CCD, current-voltage conversion is carried out by the output amplifier 45 connected to the outputting part of the horizontal transfer part 44, and it is taken out from the output terminal 46 as a picture signal.

[0037]Here, the photo-diode 41 is divided into two or more groups which consist of combination of two or more lines perpendicularly arranged with the prescribed interval. That is, each photo-diode 41 connected to the identical line of two or more lines perpendicularly arranged with the prescribed interval is treated as the same group. And the same control is performed about a charge storage to the photo-diode 41

belonging to the same group. This charge storage control is explained in detail later. Drawing 2 shows the example of the photo-diode 41 currently divided into the four groups 41A, 41B, 41C, and 41D which consist of combination in every three lines. The figure shows that A, B, C, and D which were indicated in the photo-diode 41 inside each block to express are a photo-diode belonging to the groups 41A, 41B, 41C, and 41D.

[0038]On the other hand, although usually provided in common to the row of the perpendicular direction of a photo-diode about a transfer gate, the transfer gate 42 in this embodiment is separated and formed in each photo-diode 41 by 1:1 correspondences. These transfer gates 42 are connected to every group 41A, 41B, and 41C of the photo-diode 41, and 41D in common by the common connecting line 46, and the transfer pulses SA, SB, and SC and SD are supplied from CCD driver 17 of drawing 1 via these common connecting lines 46, respectively.

[0039]Each photo-diode belonging to the same group by these supplied transfer pulses SA, SB, and SC and SD, Each photo-diode belonging to a different group so that accumulation of a signal charge may be started to the same timing, It is controlled to start accumulation of a signal charge to mutually different timing (that is, each photo-diode which belongs, for example to the photodiode group 41A is controlled to start accumulation to the same timing.). It is controlled to start accumulation to timing different on the other hand from each photo-diode belonging to the photodiode group 41A, and each photo-diode belonging to the photodiode group 41B. . And the picture signal read from the photo-diode 41 via the transfer gate 42, the vertical transfer part 43, the horizontal transfer part 44, and the output amplifier 45 is inputted into the AF treating part 14 via the image pick-up circuit 6 and A/D converter 7.

[0040]In the AF treating part 14, a high frequency component is extracted from the picture signal inputted by the highpass filter 31 from A/D converter 7. And the high frequency component corresponding to each photodiode groups 41A, 41B, 41C, and 41D is inputted into the accumulation part 33 via the switcher 32, and the accumulation value for every high frequency component is calculated as AF rating value. And based on this AF rating value, AF operation is performed by moving the focus lens group 3 to an optical axis direction via CPU15, 2nd Motor Driver 19, and the focal motor 22.

[0041]Drawing 3 is a figure showing accumulation/read operation of the signal charge in CCD5. That is, the exposure time (substantial storage period of a signal charge) of each photodiode groups 41A, 41B, 41C, and 41D is expressed as the transfer pulses SA, SB, and SC, SD, and the SUB omission pulse for sweeping out the signal charges

accumulated in the photo-diode 41 all at once. In the figure, the state a, b, and c, d, e, and f support the timing of each state of CCD5 shown in drawing 4.

[0042]Drawing 4 shows each state of the interior action of CCD5 typically. In drawing 4, the sign A, B, and C and D are also expressing the charge quantity of the signal charge accumulated in the photo-diode 41, and the signal charge in the vertical transfer part 43 while expressing the group to which the photo-diode 41 belongs respectively.

[0043]With reference to drawing 3 and drawing 4, a series of interior actions in CCD5 are explained below.

[0044]In the state a which shows in drawing 4, the signal charge accumulated in all the photo-diodes 41 is swept out by the SUB omission pulse. Then, in the state b, the transfer gate 42 connected to the photodiode group 41A by transfer pulse SA is opened, The signal charge A accumulated in the photodiode group 41A is transmitted to the vertical transfer part 43, and the signal charge again accumulated in all the photo-diodes 41 just behind that is swept out by the SUB omission pulse.

[0045]Next, in the state c, the transfer gate 42 connected to the photodiode groups 41A and 41B by the transfer pulses SA and SB is opened, The signal charges A and B accumulated in the photodiode groups 41A and 41B are transmitted to the vertical transfer part 43, and the signal charge again accumulated in all the photo-diodes 41 just behind that is swept out by the SUB omission pulse. Since the signal charge A accumulated in the photodiode group 41A at this time is transmitted to the vertical transfer part 43 2 times in the state b and the state c, it is twice the charge quantity (A*2) of this within the vertical transfer part 43. That is, the exposure time of the photodiode group 41A is set to T1 shown in drawing 3, and becomes twice a cycle of an SUB omission pulse.

[0046]Next, in the state d, the transfer gate 42 connected to the photodiode groups 41B and 41C by the transfer pulses SB and SC is opened, The signal charges B and C accumulated in the photodiode groups 41B and 41C are transmitted to the vertical transfer part 43, and the signal charge again accumulated in all the photo-diodes 41 just behind that is swept out by the SUB omission pulse.

[0047]Since the signal charge B accumulated in the photodiode group 41B like the above at this time is transmitted to the vertical transfer part 43 2 times in the state c and the state d, it serves as twice as many charge quantity as this within the vertical transfer part 43. Therefore, the exposure time of the photodiode group 41B is set to T2 shown in drawing 3. As shown in the figure, the half cycle in the first half of the exposure time T2 overlaps the half cycle in the second half of the exposure time T1.

[0048]Hereafter, same operation is performed also in the state e and the state f. As a result, the signal charge in the vertical transfer part 43 in the state f, It means that it becomes a signal charge twice the charge quantity of having been accumulated in the photodiode groups 41A, 41B, 41C, and 41D, respectively, and the photodiode groups 41A, 41B, 41C, and 41D were exposed over the period T1
half-cycle[every]-overlapped, respectively, T2, T3, and T4.
[0049]Thus, the photo-diode 41 of CCD5 is divided into two or more photodiode groups 41A, 41B, 41C, and 41D in this embodiment, He is trying to start accumulation of a signal charge to mutually different timing in each of these photodiode groups 41A, 41B, 41C, and 41D.
[0050]Therefore, by performing accumulation operation of the signal charge in each photodiode groups 41A, 41B, 41C, and 41D, moving the focus lens group 3 to an optical axis direction so that it may state below, The focal error information in several positions from which the focus lens group 3 differs based on the picture signal read from each photodiode groups 41A, 41B, 41C, and 41D, respectively can be acquired. And the judgment of a high-speed focusing position is attained using the focal error information in several of these different positions.
[0051]If it does in this way, the storage time of the signal charge in each photodiode groups 41A, 41B, 41C, and 41D will become short as compared with the conventional AF system which searches for the focal error information on two or more lens positions from the picture signal of one screen, respectively. However, by this embodiment, as mentioned above, since the photodiode groups 41A, 41B, 41C, and 41D are exposed over the half-cycle[every]-overlapped period T1, T2, T3, and T4, comparatively long charge storage time can be taken. Therefore, the level fall of the picture signal read from each photodiode groups 41A, 41B, 41C, and 41D, respectively can be compensated, and detection of focal error information, calculation of the AF rating value based on this, and the judgment of a focusing position can be ensured.
[0052]Next, based on the charge storage/read operation of CCD5 mentioned above, the concrete example of the AF operation in this embodiment is described.
[0053](Example 1) Drawing 5 shows the example of the time chart for explaining the AF operation in Example 1, and the lens position of the focus lens group 3 corresponding to the time chart concerned. The focus lens group 3 shall consider it as a single focus lens or the lens of a comparatively short focal distance, the amount of deliveries (movement magnitude of an optical axis direction) shall be comparatively small, and the amount of deliveries shall change in step over three steps (the stop position of the focus lens group 3 is four places). The transfer pulses SA, SB, and SC

shown in drawing 5, SD, an SUB omission pulse, and each exposure time are the same as that of drawing 3.

[0054]As shown in the motor drive time chart of drawing 5, at the time of AF operation, the focal motor 22 drives in step synchronizing with the impression which is the 1st time of the transfer pulses SA, SB, and SC. This drive is interlocked with, and the lens position of the focus lens group 3 stops one by one in the position of L2, L3, and L4 (the maximum near) from the position of L1 (infinite distance), as shown in drawing 5.

[0055]In the exposure time T1, T2, T3, and T4 at this time, By the accumulation part 33 in the AF treating part 14. The accumulation value of the high frequency component of the picture signal corresponding to the signal charge accumulated in the photodiode groups 41A, 41B, 41C, and 41D is calculated, respectively as AF rating value 1 corresponding to the lens position L1, L2, L3, and L4, AF rating value 2, AF rating value 3, and AF rating value 4.

[0056]Based on the size relation of such AF rating value 1, 2, 3, and 4, a focusing position is called for by CPU15. The method of determining the focusing position in the case of this Example 1 is shown below.

[0057]AF rating value 1 - Maximum -> focusing position = lens position L1 and AF rating value 1, 2 — large (any — AF rating value 3 and 4 — large) -> focusing position = lens position L2 and AF rating value 2 and 3 — large (any — AF rating value 1 and 4 — large) -> focusing position = lens position L3 and AF rating value 4 — the maximum -> focusing position = lens position L4 — if a focusing position can be found in this way, CPU15, The focus lens group 3 is made to fix to Lthe lens position L1 which is a focusing position, L2, L3, or 4, and each part is controlled to picturize in this state.

[0058](Example 2) Drawing 6 shows the example of the time chart for explaining the AF operation in Example 2, and the lens position of the focus lens group 3 corresponding to the time chart concerned. In Example 2, the focus lens group 3 shall consider it as a lens with a comparatively long focal distance, that of the amount of deliveries shall be comparatively large, and shall change in step over seven steps (the stop position of the focus lens group 3 is eight places). The transfer pulses SA, SB, and SC shown in drawing 6, SD, an SUB omission pulse, and each exposure time are the same as that of drawing 3 and drawing 5.

[0059]As shown in the motor drive time chart of drawing 6, synchronizing with the 1st impression of each transfer pulses SA, SB, and SC, it drives two steps of focal motors 22 at a time in step. And when the fur dregs motor 22 drives by one step synchronizing with the impression which is the 1st time of transfer pulse SD, the focus lens group 3 stops one by one to L1 (position at infinity) to L2, L3, L4, L5, L6, L7,

and L8 (the maximum nearby position), as shown in the lens position of drawing 6.
[0060]In each exposure time T1 shown in drawing 6 at this time, T2, T3, and T4, By the accumulation part 33 in the AF treating part 14. The accumulation value of the high frequency component of the picture signal corresponding to the signal charge accumulated in the photodiode groups 41A, 41B, 41C, and 41D as the lens positions L1-L3, L2-L5, L4-L7, L6 - AF rating value 1 corresponding to L8, AF rating value 2, AF rating value 3, and AF rating value 4. It asks, respectively.
[0061]CPU15 asks for a focusing position based on the size relation of such AF rating value 1, 2, 3, and 4. The method of determining the focusing position in the case of Example 2 is shown below.
[0062]AF rating value 1 - 4 -> focusing position = lens position L3 and 4 -> focusing position = lens position L2 and maximum -> focusing position = lens position L1 and AF-rating-value 1> AF-rating-value 2> AF-rating-value 3, and AF-rating-value 2> AF-rating-value 1> AF-rating-value 3, and AF-rating-value 2> AF-rating-value 3> AF rating value 1, Four -> focusing position = 4 -> focusing position = lens position L5 and lens position L4 and AF-rating-value 3> AF-rating-value 2> AF-rating-value 1, and AF-rating-value 3> AF-rating-value 4> AF rating value 1, 2 -> focusing position = lens position L6 and AF-rating-value 4> AF-rating-value 3> AF rating value 1, Two -> focusing position = Lens position L7 and AF rating value 4 maximum -> focusing position = lens position L8CPU15, Thus, if a focusing position can be found, the focus lens group 3 will be made to fix to Lthe lens position L1 which is a focusing position, L2, L3, L4, L5, L6, L7, or 8 like Example 1, and each part will be controlled to picturize in this state.
[0063](Example 3) Drawing 7 is a time chart for explaining the AF operation in Example 3, and is the example for which it was suitable when the luminosity (illumination) of a photographic subject was comparatively low.
[0064]Unlike Examples 1 and 2 shown in the example of CCD5 of operation and drawing 5, and drawing 6 which were shown in drawing 3 and drawing 4, the transfer pulses SA, SB, and SC shown in drawing 7 and SD are impressed 3 times continuously. That is, the signal charge accumulated in each of the photo-diode 41 in CCD5 is transmitted to the vertical transfer part 43 3 times respectively via the transfer gate 42. Therefore, since the exposure time T1 shown in drawing 7, T2, T3, and T4 become long with 1.5 times in the case of drawing 3 - drawing 6, even when a photographic subject is dark, sufficient light exposure is secured, and a value reliable as AF rating value 1, 2, 3, and 4 is obtained.
[0065]The method of determining a focusing position based on AF rating value 1, 2, 3,

and 4 in this example 3 may be the same as that of Examples 1 and 2. It may be made to change the impression cycle of a transfer pulse to a multi stage story further according to the luminosity of a photographic subject.

[0066]Thus, the thing (.) for which the applied period of a transfer pulse is changed according to the luminosity of a photographic subject Namely, by shortening the applied period of a transfer pulse, when a photographic subject is bright, and lengthening the applied period of a transfer pulse, when a photographic subject is dark, It is not based on the luminosity of a photographic subject, and the picture signal of the correct level in which processing by the AF treating part 14 is possible can be acquired, and it is not based on the luminosity of a photographic subject, but good AF operation becomes possible.

[0067]By the way, even if it is using the image data which shifted several lines by the shaking hand in the camcorder marketed, there is no trouble on AF operation performance. Since the camcorder of NTSC is an interlace, the field image data outputted one by one is image data shifted one line. However, even if it uses the image data which shifts one line and is outputted by turns, similarly on AF operation performance, it is completely convenient.

[0068]On the other hand, AF operation explained in the above-mentioned Example 1, Example 2, and Example 3 was performed based on each picture signal corresponding to each signal charge accumulated in the photodiode groups 41A, 41B, 41C, and 41D. These four photodiode groups 41A, 41B, 41C, and 41D were divided by combining each photo-diode 41 at intervals of three lines. Therefore, the data for every combination of two or more lines outputted one by one as shown below is being used for the AF operation in each example.

[0069]

- The 1st outputted image (... zero line, four lines, eight lines, and 4*n line)
- The 2nd outputted image (... one line, five lines, nine lines, and 4*n line)
- The 3rd outputted image (... two lines, six lines, ten lines, 4*n line)
- The 4th outputted image (... three lines, seven lines, 11 lines, 4*n line)
- The 5th outputted image (... zero line, four lines, eight lines, and 4*n line)

Therefore, each image data outputted one by one means being data of another position.

[0070]That is, in each example mentioned above, although the image data of four lines and **** is used, if CCD5 is very a high pixel compared with NTSC, a problem in particular will not be produced. If it puts in another way, about the same ability as NTSC is securable by making CCD5 into a high pixel in each above-mentioned

example.

[0071]In the AF operation explained in each example, in order to earn a light exposure (exposure time), the data for every combination of two or more lines outputted one by one is read so that exposure may lap. On the other hand, although accompanied by reduction in a light exposure, it is also possible to read so that each data may not lap, as shown in drawing 8.

[0072]

[Effect of the Invention]As stated above, after dividing the optoelectric transducer of an image sensor into two or more groups which consist of combination of two or more lines arranged with the prescribed interval according to this invention, The optoelectric transducer belonging to a group which the optoelectric transducer belonging to the same group is the same timing, and is different controls charge storage start timing to start a charge storage to mutually different timing, Based on the picture signal read from each of these photoelectric conversion element groups, it is possible to judge a focusing position by one image pick-up of an image sensor, and improvement in the speed can be attained by moving an imaging lens to this focusing position, maintaining the accuracy of AF operation.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The block diagram showing the composition of the electronic image pickup device concerning one embodiment of this invention

[Drawing 2]The figure showing the composition of CCD in the embodiment typically

[Drawing 3]The time chart for explaining operation of CCD in the embodiment

[Drawing 4]The mimetic diagram for explaining the interior action of CCD in the embodiment

[Drawing 5]The time chart for explaining the AF operation in the embodiment

[Drawing 6]The time chart for explaining other AF operation in the embodiment

[Drawing 7]The time chart for explaining another AF operation also in the embodiment

[Drawing 8]The time chart for explaining other AF operation in the embodiment

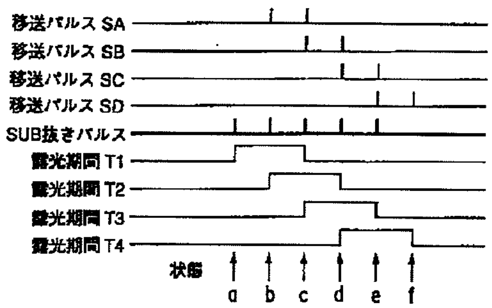
[Description of Notations]

1 --- Imaging optical system

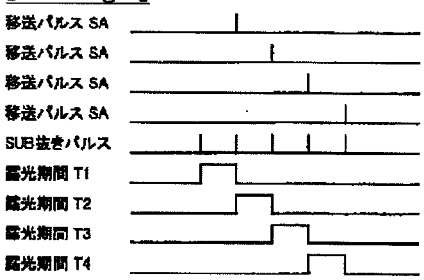
2 — Zoom lens group
3 — Focus lens group
4 — Diaphragm
5 — CCD (image sensor)
6 — Image pick-up circuit
7 — A/D converter
8 — Buffer memory
9 — D/A converter
10 — LCD (liquid crystal display)
11 — Compression/expansion circuit
12 — Memory for record (recording medium)
13 — Air entrainment part (automatic exposure treating part)
14 — AF treating part (automatic focusing adjustment treating part)
15 — CPU
16 — Timing generator
17 — CCD driver
18–20 — Motor Driver
21 — Diaphragm motor
22 — Focal motor
23 — Zoom motor
24 — Final controlling element
25 — EEPROM
31 — Highpass filter
32 — Switcher
33 — Accumulation part
41 — Photo-diode (optoelectric transducer)
42 — Transfer gate
43 — Vertical transfer part
44 — Horizontal transfer part
45 — Output amplifier

DRAWINGS

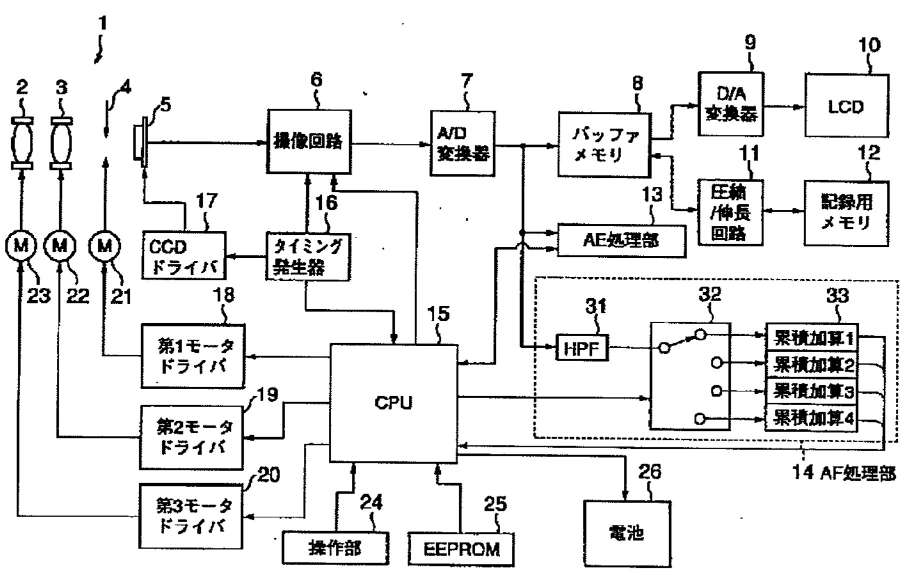
[Drawing 3]



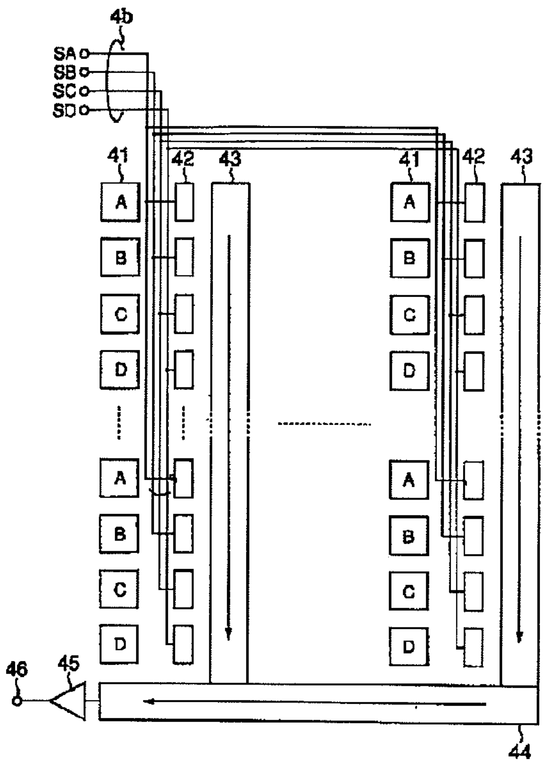
[Drawing 8]



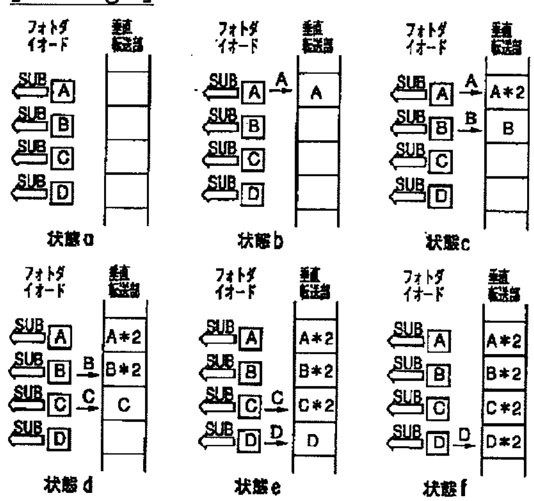
[Drawing 1]



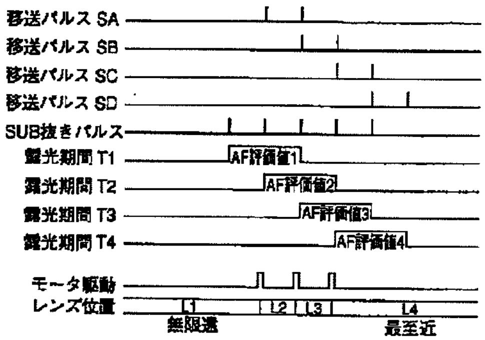
[Drawing 2]



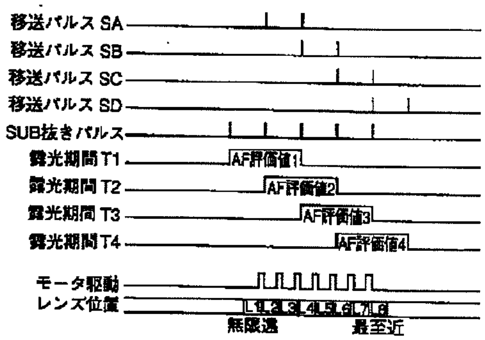
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Drawing 7]